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From silos to crossing borders in physical education

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From silos to crossing borders in physical education

Physical education has become more than a superficial exposure to a range of motor skills and movement challenges through the emergence of a myriad of educationally-focused initiatives, models and theoretical approaches. Such proliferation of ideas has been positioned within the literature as both a strength and a weakness. While ideas can be strengthened through focused and inward-looking practice, an increasing array of foundational ideas with disparate language, can make the territory of physical education increasingly more difficult to navigate across divided discourses leading to a potentially shallow base. This research articulates a deliberate process of border crossing that we undertook as a way to seek a convergence (where possible) between two related frameworks for understanding and progressing physical education. We acknowledge this exchange of ideas is something that happens frequently and informally between different educators and researchers. Yet we suggest that there is room for those willing to undertake a more deliberate transformational approach to border crossing with the potential to yield innovative outcomes through the integration of ideas from different fields. Opportunities can emerge for educational developments as a consequence of working at these borders/boundaries. To better understand deliberate approaches to border crossing, we draw largely upon ideas from transdisciplinary research, concept analysis, boundary crossing and threshold concepts to reflexively interrogate our own uncertain, at times messy and iterative approach of reconciliation from either side of the globe. The paper offers insights and guidance for others who wish to more formerly seek out synergies through a process of disciplinary border crossing.

Keywords: Physical education; concept analysis; comparative analysis; transdisciplinary; complexity; social-ecology

Subject classification codes: include these here if the journal requires them

Introduction

In this paper, we borrow the term border crossing from Evans (2014) and recognise, on a relatively equal footing, the term ‘boundary crossing’ (Akkerman and Bakker, 2011; Penney, 2013). We do this to help describe our attempts to bridge points of division amidst disciplinary knowledge structures within and beyond physical education. We commence with an exploration of border/boundary crossing, before drawing upon ideas from transdisciplinary research, concept analysis and threshold concepts in order to produce guiding principles to frame this type of work. From here, we reflexively employ these principles to explore data from our own efforts to synthesise two similar conceptual approaches to physical education. We conclude the paper by considering the potential of this frame as a device to facilitate further border crossing attempts. In ourselves, we recognize a redefining of our role as educators to be ‘...border crossers who engage in intertextual negotiations across different sites of cultural production’(Giroux, 2001, p. 6). This research presents insights into the process of disciplinary border crossing and in doing so offers a potentially useful frame for others, including teachers, interested in creating a more connected, cohesive and mature vision for physical education.

Front matter

In the 21st century, much of the education profession is shifting away from the modernist notions of certainty and causality that have long dominated thinking and practice. The significance of this move cannot be ignored for, as Davis and Sumara (2010, pp. 856-857) have noted, ‘the project of education is among the most complex of human enterprises, arising in the nexus of individual interest, social need, disciplinary diversity, cultural self-perpetuation, and humanity’s efforts to situate itself in the more-

than-human world.’ Instead of focussing on a ‘grand narrative’ for education, we are witnessing the emergence of new ways of thinking and practising: ways that acknowledge humans and their learning as more open-ended, situated and connected. Like many, we wholeheartedly support this more contemporary view of education.

This shift in focus, however, is not without its problems. Tensions and barriers have appeared as different discourse communities develop their own sophisticated language (Tinning, 2015) and create specialised scholarly societies that support their sub-disciplinary preferences and affiliations (Lawson, 2008). This is not to suggest we must shift to a form of holism or universality and that ideas cannot or should not be independent. We recognise that significant disciplinary depth within the boundaries of particular disciplinary areas plays an important role in creating a mature field of study. Rather, we agree with (Penney, 2013) who draws on Bernstein (2000) to suggest that ‘boundaries can be seen to represent a potentially productive point of tension between the past and possible futures’ (p.7). Penney (2013) describes boundaries as permeable and encompassing overt, symbolic and ‘social points of division and connection amidst contemporary knowledge structures’ (p. 7). Evans’ (2014) uses the term border crossing to refer to a broad concept of sharing thought, practice and resources within intellectual communities and between contexts (ie. academia, professional agencies). We see opportunities in border or boundary crossing for a wider range of educational developments to arise from working at these borders/boundaries.

This thinking parallels contemporary calls for more inter- and transdisciplinary approaches to research (Horlick-Jones and Sime, 2004). These calls are pushed by a strengthening recognition that the problems of society are not isolated to particular disciplines, but are increasingly complex and interdependent (Klein, 2004). Klein (2004) argues that the need for transdisciplinarity is now pervasive in research fields

that involve human interaction with natural systems and ‘where social, technical, and economic developments interact with elements of value and culture’ (p. 517).

According to Klein (2004), segmented ways of thinking have reached their limits for solving problems. However, while moves towards more connected and integrated ways of thinking and practice seem to be a logical way forward, the reality is different.

Because most academics invest considerable time and effort developing an in-depth understanding of one specific discipline, often under the ‘guidance’ of their supervisors (Davies, 2016), engaging in interdisciplinary or transdisciplinary thinking rarely features in their research agendas. It is commonplace therefore, for academics to become ‘threshold guardians’ (Davies, 2016) in support of their discipline or sub-discipline. Our own experience of operating in the parallel areas of social-ecology and complexity highlights an opportunity lost for, at least from the outside, the areas appear to have arbitrary and almost non-existent boundaries. With this background in mind, the paper now turns towards physical education as first, a context to investigate the impact of this contemporary fragmentation issue, and then, to consider ways this problem may be addressed.

Emerging ‘Camps’ Within Physical Education

While physical education has been a constant feature of most national curricula for the last century (Puhse & Gerber, 2005), attention is regularly drawn to the subject’s low standing and marginalized status (Oslins & Stoltz, 2013). Emerging from this precarious situation, the last 20-30 years has seen the subject become more nuanced amidst a myriad of educationally-focused initiatives (see Ennis, 2017). A raft of developments either espouse different theoretical stances or present independently-labeled approaches that are now, to differing degrees, part of this educational vision for physical education. Our individual interests in social ecology and complexity thinking are part of this

increasingly crowded arena. This degree of innovation is even more apparent amongst developments focused on skills, tactics, games and sports. New thinking and new approaches informed by a range of theoretical and disciplinary perspectives continue to emerge under the banner of physical education.

With each new initiative, however, physical education is splintering into different and potentially disconnected ‘camps’. Tinning (2015), reflecting on recent curriculum initiatives, signposted this impending dilemma when he said, ‘There is so much “out there”. But what is also obvious to me is that those studying learning tend to work in different isolated discursive communities’ (Tinning, 2015, p.676). Using Kretchmar’s (2008) analogy of the silo, Tinning (2015, p.676) presents a worst-case scenario in which each silo ‘reinforce(s) a form of tribal-type identification’ and ‘present(s) practical problems related to fractionation, poor communication, and lack of mutual respect’. Evans (2014, p. 55) illustrates this point by suggesting that students of sociology within physical education and health are ‘...too often required to learn to speak particular social theoretical languages, for example, of Marxism, or post-structuralism, or figurational, interpretive or critical social theory, and tend to become socialized deeply into the underlying codes and modes of their (or more particularly, their teachers’) perspectives’. Tinning (2015) suggests these different ‘siloes’ developments are having a negative impact on the potential of physical education to develop as a mature field of study.

While we do not propose physical education has reached its Armageddon, we are conscious of tensions and barriers as different ‘camps’ develop their own complex and exclusive language to describe concepts that may be relatively similar. Further, as Evans (2014, pp. 55-56) suggests, having spent years determining what stance to take and what approaches they will represent, our students learn to enter research

environments with their ‘eyes wide shut to the possibilities that other perspectives and forms of theory and professional understanding might offer...’ leaving one ‘afraid to think outside the frame’. With so many well-meaning efforts attempting to create new educational visions for physical education, we find ourselves identifying with Tinning’s view that there is, as yet, ‘little building of a substantial coherent accumulative knowledge base’ for physical education (Tinning, 2015, p.676).

Despite highlighting the perils and pitfalls of border crossing within and across disciplines, Evans (2014) suggests:

...there are real merits of making border crossings at least of an ideational kind in academia, education, PE, sport and health and that now, more than ever, are they needed if our goal is to advance thinking in our subject/discipline. (p.49)

He points out that ‘border crossings have arguably never been more necessary or vociferously articulated while also never being less likely to occur’ (p.48). Operating on the boundaries/borders, or in the in-between spaces, is not without risk for academics. A climate of performativity, where emerging factionalism and the need for academics to develop a clearly defined research identity do not fit well with notions of generalizability and collaboration across a field of study (Evans, 2014). Lawson (2008) identified a long-standing frustration at efforts to integrate ideas within the academy. Stymied by doctoral programs and career structures that failed to provide common purposes, shared missions and a collective identity, Lawson (2008) witnessed how reproducing structures, custodial orientations and operational processes maintained the status quo.

Border crossing is also challenging because it sometimes succeeds only following significant time and effort (Davies, 2016). Evans (2014, p. 51) suggests similar:

‘To ‘unlearn’ (or at least seriously problematise) the foundational assumptions, concepts, ideas, of one’s discipline and the criteria used to assess and evaluate the knowledge it produces is, of course, a pretty big ask...Learning the language of one’s own discipline is challenging enough let alone those of others.’

Also problematic are disciplinary disrespect (Stokols et al., 2003) and the appropriation of disciplinary knowledge as a result of a failure to consider notions of power and vested interest (Evans, 2014). Almost any field of activity or knowledge can legitimately be appropriated into disciplinary discourse’ and the assimilation or colonisation of another disciplines’ property needs careful consideration (Davies, 2016, p. 129). Stokols, et al. (2003, p. S33) suggests these issues are ‘consistent with earlier analyses of departmental ethnocentrism and tribalism. The cultivation of disciplinary open mindedness is therefore important (Davies, 2016; Evans, 2014; Giri, 2002; Stokols, et al., 2003).

Despite these difficulties, in the context of research, transdisciplinary work is now widely regarded (Holzer, Carmon, & Orenstein, 2018; Klein, 2004, 2008; Nowotny, Scott, & Gibbons, 2003; Stokols, et al., 2003; Wells, 2009), with large amounts of grant monies being attached to transdisciplinary teams (Magill-Evans, Hodge, & Darrah, 2002). Missing at this institutional level, however, is a focus on the ‘self-preparation that is required on the part of the researchers and community of researchers’ to do transdisciplinary work’ (Giri, 2002, p. 105). In this respect, crossing disciplinary boundaries can be considered a complex social process and not something to be simply undertaken.

In an attempt to identify the ‘work’ needed to realise border crossing, we now outline our approach towards developing a set of principles that we later use to interrogate our

initial efforts to explore each other's thinking in social ecology and complexity. In applying these principles, it is not our intention to present new insights for our respective theoretical areas (forthcoming), rather to share what we have learnt about border crossing and provide support for others who may wish to do the same. We conclude the paper by presenting these principles as a frame that others can modify, build upon or challenge in their own attempts to integrate different theoretical perspectives that currently shape the nature of contemporary physical education.

Approach

Our research aims to understand a process of border crossing where we:

- a) Use a snowball sampling of key literature from which we synthesise a set of principles that serve as a guiding framework to explore crossing disciplinary borders.
- b) Reflexively deploy these principles to interrogate data generated from our own efforts to converge two similar theoretical positions. The intent is to test the utility of the principles for future use as a methodological device and/or time-saving resource.

The approach we took was iterative, cooperative and theoretical (Klein, 2010) and unfolded as a border crossing exercise in and of itself. Regarding our own border-crossing process, it was trans/intradisciplinary as distinct from interdisciplinary as it involves 'narrower-gauged integration among the concepts and methods of "neighboring" disciplines that share the same levels of analysis' (Stokols, et al., 2003, p. S24). We acknowledge that broad interdisciplinarity will likely be more complex due to different paradigms or methods involved (Klein, 2010).

We were initially directed by Evans (2014) to explore 'concept analysis' (Davis and Sumara, 2010). While this led to a limited explanation within mathematics, it also led us to threshold concepts as a way to consider transformation in understandings (or not)

(Land, Meyer, & Baillie, 2010; Meyer and Land, 2005). Threshold concepts contributed the idea of liminality (getting stuck) where the boundary is not a doorway to walk through but a liquid, oscillating space both transforming and being transformed by the learner (Land, et al., 2010; Meyer and Land, 2005). In addition, transdisciplinary research provided us with tools to interpret border crossing (Holzer, et al., 2018; Klein, 2008; Stokols, et al., 2003) although we discounted elements relevant to large multi-disciplinary research teams. We then re-established connection with concept analysis through the nursing literature (Risjord, 2009; Sykes, Wills, Rowlands, & Popple, 2013), whilst also accommodating aspects of reflection and transformation from boundary crossing processes outlined by Akkerman and Bakker (2011) . Having adopting Evans' (2014) term 'border crossing', given the symbolism of borders as defined lines we later found merit in the more fluid term 'boundaries'. According to Akkerman and Bakker (2011), boundary crossing is carried out by a person transitioning and interacting across different sites (physical sites, work sites or knowledge sites) while boundary objects refer to artifacts that do the crossing and serve a bridging role (i.e. structures, records, policies). Conscious of the work already done in these parallel areas, we consequently make no claims to be dealing in theoretically innovative ideas. Our focus was primarily pragmatic and aimed at an intimate, small-scale academic collaboration, with one eye on applicability for teacher practitioners grappling with similar competing ideas. With its focus on practicality, the review drew upon the elements noted above to form a set of guiding principles we could apply to our own border crossing efforts.

We use our own border crossing attempts as the basis to retrospectively test the guiding principles. Following an initial face-to-face meeting in December 2016, the period from February – April 2017 led us to write a narrative of our research histories and to complete independent annotations of each other's research papers. This initial data was

used as a source to undertake monthly online conversations that yielded five 60-minute transcriptions in which concepts and applications of our work were discussed. Prior to writing this paper and to better understand the process we undertook, we re-read all transcripts, histories and annotations. This data was used as a point of comparison with the guiding principles to help assess their utility. A detailed overview of these sources of data and the process we went through is presented as part of the analysis and follows the presentation of the analytical frame below.

Reflexivity and Trustworthiness

We were both intimately involved in all aspects of the research process acting as researchers and participants, questioners and responders. As researchers and subjects, we recognised we could be accused of constructing border-crossing frame that aligned too neatly with our process. We cannot argue we could completely separate our experience from any frame used to interrogate it, but we did make efforts to bracket, or set aside, our process and let the frame be informed by research. Because our intent is to show points of tension as well as possibilities, the analysis of our process data using the frame, was done from a critical perspective.

Findings

Our findings are split into 2 related subsections. We first synthesise key points from current literature to present a set of five guiding principles to frame our deliberate and transformational border crossing process (see Table 1). We then use these principles to revisit and reflexively interrogate our initial border crossing efforts.

Principle	Informed by	Sources
1. variability and uncertainty	Boundary Crossing	(Akkerman and Bakker, 2011)
	Transdisciplinary research	(Klein, 2004, 2008; D Stokols, 2006)
	Concept study	(Davis and Sumara, 2010)

2. Social and emotional participatory process	Transdisciplinary research	(Klein, 2004, 2008; D Stokols, 2006)
	Concept study	(Davis and Sumara, 2010)
	Threshold concepts	(Land, Meyer, & Flanagan, 2016)
3. Rules of engagement and supportive structures	Boundary Crossing	(Akkerman and Bakker, 2011)
	Transdisciplinary research	(Klein, 2004, 2008; D Stokols, 2006)
	Concept study	(Davis and Sumara, 2010)
4. Conceptual knowledge is contested without need for consensus	Boundary Crossing	(Akkerman and Bakker, 2011)
	Threshold concepts	(Davies, 2016; Meyer and Land, 2005)
	Concept study	(Davis and Sumara, 2010)
	Concept analysis	(Risjord, 2009; Rodgers, 2000; Sykes, et al., 2013)
	Vertical Compatibility	(Barkow, 2005)
5. An ongoing process where translation is difficult, but can yield sustainable change.	Transdisciplinary research	(Klein, 2004, 2008; D Stokols, 2006)
	Boundary Crossing	(Akkerman and Bakker, 2011)
	Threshold concepts	(Land, et al., 2016; Meyer and Land, 2005)

Table 1: Border Crossing Principles

Principle 1: Border crossing requires variability and uncertainty

As a starting point, border crossing involves two interrelated factors: an acknowledgement of variability between the different perspectives involved and a recognition that as these perspectives weave together the border crossing process will likely lead to new, often unanticipated, outcomes (Davis and Sumara, 2010; Klein, 2008). According to Akkerman and Bakker (2011), confronting boundaries requires the realising and explicating of difference in order to learn something new about your own and other's practice. New ways of thinking often evolve organically and produce considerable innovation if they are not imposed or predetermined (Davis and Sumara, 2010). In addition, as these new perspectives emerge, they may lead to the creation of innovative frameworks and solutions that have the potential to generate transcendent theoretical approaches and practices (Akkerman and Bakker, 2011; Stokols, et al., 2003). The variability between the perspectives also drives a need for different ways of

accounting for the quality of outcomes (Klein, 2008).

Principle 2: Border Crossing involves a participatory process that is both social and emotional

Despite Evans (2014, p. 49) reluctance to make border crossing a socially collaborative act, he acknowledges it is perhaps ‘a necessary feature of more lasting engagements’ (p. 49). For Davis and Sumara (2010), border crossing should be a participatory and social process of knowledge production, where participants actively shape possibilities as a consequence of choosing and amplifying particular ideas, clarifications, and applications. This collaboration emphasises mutual learning through joint activities that foster common conceptions, mutual knowledge development, novel insights, redefined boundaries and integrative frameworks. Transdisciplinary research stresses the need to emotionally embrace a ‘transdisciplinary ethic’ (Klein, 2008; Stokols, et al., 2003), where there is an intent to focus on shared problems (Akkerman and Bakker, 2011). However, this participatory process might be troublesome and involve periods of liminality because ideas from another discipline may be conceptually difficult, tacit, unfamiliar or perhaps because actors remain ‘defended’ and reluctant to let go of their way of thinking (Land, Meyer, & Flanagan, 2016). Constructive and productive interactions among team members within a climate of trust and effective communication are important.

Principle 3: Border Crossing involves rules of engagement and supportive structures

Border crossing requires the establishment of rules that govern the process within supportive structures (Klein, 2008). Davis and Sumara (2010) suggest that applying a set of enabling constraints act as the limiting conditions that define the field of play.

This means describing what cannot be done in order to allow for everything else (e.g. rules in sport). As already outlined, the uncertainty of border crossing suggests some degree of flexibility and adaptability is needed as the process progresses. Participants should meet periodically (preferably in person) and take on roles like scheduling meetings and identifying tasks to progress the endeavour (Klein, 2008; Stokols, et al., 2003). Beyond people, objects and structures, including facilities and equipment, can move across borders (boundary objects). These objects can foster communication, allow time for interaction, enable shared decision making or be organic arrangements that facilitate movement between structures (Akkerman and Bakker, 2011; Klein, 2008; Stokols, et al., 2003). Boundary objects work when designed to anticipate multiple perspectives and adopt a common enough structure to provide shared meaning across multiple perspectives (Akkerman and Bakker, 2011). Whilst these may not be a direct substitute for collaboration, they can be used to displace elements of communication or practice (Akkerman and Bakker, 2011). To be effective, additional information about history and negotiation may be required (REF??).

Principle 4: Border Crossing acknowledges knowledge as contested without need for consensus

Crossing borders requires embracing the idea that knowledge domains are contested (Davis and Sumara, 2010). Akkerman and Bakker (2011) outline how confrontation can yield productive or transformative outcomes. They also refer to the reflective impact of boundaries where a negotiated practice of perspective making makes implicit knowledge and assumptions explicit. This can be combined with perspective taking where one can look at oneself through the eyes of the other, generating something new. Accordingly, Dewey (cited in Davis, Sumara & Luce-Kempler, 2006 p. 156) as long ago as 1902, noted that we should ‘abandon the notion of subject-matter as something

fixed and ready-made in itself' and recognise it to be 'something fluent, embryonic, vital'.

Consequently, to cross borders with the intent of transformation, agreement and consensus is not always necessary. This is where a potential divide in our guiding principles emerges. Problems can arise when conflicting epistemological claims cannot be reconciled leaving us with 'pluralistic regimes of truth' (Davies, 2016, p. 131). Klein (2008, p. 119) suggests "compromises must be made, and the best option may be a partial, negotiated consensus", Davis and Sumara (2010) propose that

dissenting voices and the jagged edges of contrasting opinions leads to collective products that are more useful and more insightful than the lowest-common denominator solutions that seem to spark little disagreement (and, consequently, limited engagement) (p. 859)

Davies (2016) ultimately concurs with this latter view by suggesting some threshold concepts cannot be readily traversed and are best left as points of difference. If these threshold concepts are accepted as incommensurable, it offers a way for 'different tribes' to retain their integrity without impinging on others' (Davies, 2016, p. 132). Akkerman and Bakker (2011) take a best of both worlds approach, suggesting as new hybrid areas emerge, they can maintain and even build on familiar fields of core research.

To progress, crossing borders likely involve attempts to gain shared understandings of key concepts or propositions. Tinning (2015) puts forward an idea from Barkow (2005) that does not require transdisciplinary face-to-face interactions between researchers, but rather an exploration of vertical compatibility.

.. knowledge from one discourse community (e.g. constructivist theories) would be considered ‘in the light of’ knowledge from other learning discourse communities (e.g. behaviourist or cognitivist theories) with the purpose of making a judgement on compatibility or otherwise. If non-compatibility is observed then one or other (or possibly both) theories might be inadequate or just plain wrong. (p. 687-688)

As Tinning suggests, this process can be mired in misinterpretation of the language, ideas and metaphors common to discourse communities. Concept analysis attempts to deal more specifically with identifying concepts, tracing their origins and applications and considering the different ways in which they appear within and outside the field (Davis and Sumara, 2010; Risjord, 2009; Rodgers, 2000; Sykes, et al., 2013).

Ontological decisions about relativism and contextualisation need to be considered as the extent to which the context of concepts are theoretical or conversational (Risjord, 2009). Outlining an approach to concept analysis, based upon the work of Rodgers (2000), Sykes, et al. (2013) propose undertaking an analysis of: key characteristics that define the concept; references of how the concept is used to refer to things; antecedents needed for the concept to occur; consequences as a result of the concept; alternate terms that could be used instead and; similar terms or other concepts. Davis and Sumara (2010) use a more social approach referred to as ‘concept study’ that advocates the use of simultaneities to breakdown unhelpful dyads in a process that is ‘participatory rather than transmissive’. They illustrate how simultaneities like diversity and redundancy are both important in border crossing.

Discussing threshold concepts, Meyer and Land (2005) suggest that when learning new concepts there may be oscillations, liquidity and even an inability to achieve a transformed status. Like those above, they reject objectivist assumptions and point to

variation in understandings and the need for ongoing enquiry. The risk of universal concepts is that they can lead to a separation from reality and the subsequent misrepresentation of the complex social phenomena inherent in the area. In crossing borders, it appears that boundaries can be viewed more productively as points of connection, fluid in nature and where contestation can yield productive outcomes. Consensus is not a requirement and, if the path of least resistance is adopted, the outcomes may indeed be unproductively bland. A border crossing exercise can lead to the maintenance of existing boundaries and that is ok.

Principle 5: Border crossing is an ongoing process where translation is difficult, but can yield sustainable change

Klein (2008) views transdisciplinary research as an iterative process, spread across phases and involving cycles of feedback. Time is necessary to develop relationships, build trust, understand divergent perspectives and work through the decoding process in a face-to-face manner (Stokols, et al., 2003). Time also enables synthesis to emerge from patterns and relations observed in materials, ideas, and methods (Klein, 2008). Akkerman and Bakker (2011) suggest that insufficient real dialogue and continuous work at the boundary could explain a lack of findings supporting lasting transformations. If the border crossing process involves threshold concepts, then it generally involves significant shifts in perceptions, the exposure of previously hidden relations, a level of irreversibility and can be frequently troublesome (Land, et al., 2016). In outlining this process, Meyer and Land (2005) note how ‘transformation can be protracted, over considerable periods of time, and involve oscillation between states, often with temporary regression to earlier status’ (p. 376). Time may be an important precursor to impact, however this impact is not always predictable, can be unintended or dispersed and can struggle to get traction within any particular area. Crossing borders

may therefore not yield immediate, obvious or indeed any sustainable results. Akkerman and Bakker (2011) thus point to the difficulty in reaching ‘crystalisation’, where outcomes have potential to impact practices, processes, norms, values or procedures and if realised, may require ongoing work to be sustained. Stokols et al., (2003) suggest that publications and recognition are important elements that can contribute to translation. Border crossing, nevertheless, may be an ongoing process where one border crossed leads to the next.

Applying the guiding principles to interrogate border crossing

In this section, we take the principles and retrospectively interrogate our own border crossing efforts. Our analysis stems from four combined data sources: our initial face-to-face meeting; our historical summaries; the annotations of each other’s key papers and transcripts of the five online conversations during February to April 2017. As noted earlier, it is not our intention to simply fit the findings into the border crossing principles but to explore the utility of these principles as a tool to be refined in future border crossing efforts.

Principle 1: Variability and uncertainty

The first three principles played a significant role in setting up the more conceptual discussions that took place in principles 4 and 5. From the start of the initial face to face meeting, our discussion highlighted the variability in our understandings and the uncertainty in the outcomes of our project. The variability was highlighted initially by what we understood in common i.e. the world consists of nested dynamic systems. In making this clear, we were able to identify the alternate perspectives that needed bridging. While we felt that working towards clarification might yield something

mutually beneficial, either theoretically or in outputs, these remained ill-defined. We expressed an initial intent to embark on a theoretical border crossing, where we were prepared to have our original theoretical concepts modified through cooperation (Klein, 2008). The intent was fueled by the idea that the messages we were presenting to the field from our relative silos, may resonate more strongly as a more united knowledge base. Peter (*name changed for anonymity*) reflected on this in the following:

I thought, it would be good to have a purpose, something like extending boundaries or identifying synergies or that kind of notion of, we both want to progress a particular idea, and maybe in isolation we would struggle to do that, but in combination it might be a stronger message. So, the intent for me...my purpose for doing this is to learn your understandings of complexity theory, but also to hopefully join forces to push a united message and get it out there.

John (*name changed for anonymity*) responded by noting an awareness of the increasing disconnect and it was this ‘disconnect that is problematic...because you’ve got people thinking the same thing, but conceptualising it and languaging it, [differently] and it becomes too hard to spend the time [to resolve it]’.

Principle 1 adequately describes our own experience and was evident in the absence of clear-cut goals, clearly articulated outputs, or even an understanding of a process. In addition, John illustrated a core element of Principle 1, the potential to find unanticipated outcomes in the following:

what comes out the other end...for a whole host of situational or contextual or ecological reasons, it becomes something a little bit different.

In making the effort to cross borders we thought we might collectively have the potential to see things in new ways and have eventually a more solid footing on which to progress the field. We were generally comfortable with this uncertainty and felt it

was important enough to invest time in. In retrospect, we met the pre-requisite conditions for embarking on and committing to border crossing.

Principle 2: A social and emotional participatory process

Our initial meeting also generated the participative and social nature of our border crossing efforts. Whilst not requiring high levels of collaboration (Klein, 2010; Tinning, 2015), an initial conversational experience was fundamental in establishing that we trusted each other, could work together and, in socially negotiating our approach to communication, we avoided transmission within an unequal power structure. Upon reflection, we listened intently to each other and acknowledged that we were both confident and open enough to consider novel conceptual ideas that could yield different theoretical approaches or interpretations. We were also able to establish a willingness for perspective taking (Principle 4) enhancing the likelihood of successful negotiation of contested knowledge. This initial discussion also helped identify key conceptual influences and formative ideas which were later formalised as part of our border crossing process. Davis and Sumara (2010) highlight that social interaction enables the identification of the redundancies pivotal to progressing through Principle 4.

Taking time to unpack our histories, find redundancies and to ‘get to know each other’ appeared significant in avoiding the pitfalls of vested interest, disciplinary disrespect or the appropriation of disciplinary knowledge. Evans (2014) acknowledged these social elements are a necessary feature of more lasting engagements and subvert any significant road block. In our case, communication and trust building appeared to facilitate border crossing and our capacity to emotionally embrace the process.

Principle 3: Rules of engagement and supportive structures

Linked to this participative element, Principle 3 recognises the need to establish rules and supportive structures to enable engagement in border crossing. Whilst our rules were vague, we established a game plan that set some initial deadlines and broke the work into phases. After reading each other's formative academic histories and key research papers, Peter suggested:

...there was a phase of annotation and analysis, so complementary ideas, points of tension and sort of potential ways of synergy, and then I thought we would have this kind of response to each other, so talk to each other about the papers, and then consideration of that, and then I think what we do is we end up in a fourth phase, merging ideas and writing a synthesis kind of paper.

As the project progressed, we updated the rules at the end of each online conversation in ways that were fluid and dynamic. We outlined a process for monthly meetings and at each conclusion always set a date for the next meeting with actions to be addressed. We took turns to share tasks and, importantly, were comfortable enough within our workplace context to dedicate the time needed. We also had the technical capability to enable regular contact. The combination of these structural boundary objects and the capacity to share communicative boundary objects, such as histories, readings and conversation transcripts, meant there was significant movement across boundaries outside of face-to-face time. Conducting the historical narratives and completing annotated analyses of core research papers helped displace the need for extended face-to-face discussion. In our case, the boundary objects generally worked because they had a common enough language and a structure that provided substantial information. Much of our face-to-face time was subsequently spent affirming the synergistic nature of our respective positions. It is worth noting however that other boundary objects (e.g. university performance review systems) worked to keep us contained within a particular

‘research identity’, framed by a research trajectory that told a clear story about our particular expertise in a particular field tied to our productivity. In hindsight, and in line with principle 3, we would have benefited from greater process guidance and structure to become more ‘efficient’. However, we were resourced enough to make the time and prioritise this process alongside the usual deadlines associated with grants, book contracts and reporting has probably worked as an enabling factor in our project.

Principle 4: knowledge as contested without need for consensus

While principles 1, 2 and 3 helped create a positive foundation for our border crossing efforts, we did not experience knowledge as being contested as outlined in Principle 4. In fact, to quote Peter, our border crossing experience was spent mostly in ‘violent agreement’. We addressed the unpacking of concepts by discussing and then narrating our academic histories and also sharing a foundational research paper that was reviewed and annotated by the other. At the time, we were unsure why sharing our academic histories was important, but in applying Principle 4, we recognised how these histories proved pivotal in allowing for perspective making and identifying redundancies (Davis and Sumara, 2010). We identified similar histories in motor learning and control and a common adoption of dynamical systems thinking earlier in our careers both of which yielded points of divergence into social ecology and complexity thinking. These redundancies provided a platform, including a common language, from which we could effectively work with each other and find ways to expand our ideas. When annotating John’s paper, Peter illustrated this redundancy when he returned to a shared dynamic systems language to check his understanding of the term ‘recursive elaboration’, outlined in the following.

That is, attractor wells are hollowed out, perception-action couples are strengthened, and affordances become more obvious with each varied connection that occurs in the immediate environment.

This common ground gave us a sense of confidence as outlined in the following comment by John:

...how our take on systems has evolved, even the fact that my take...my starting point is...not exactly the same...as yours...[but] they're both ecological, and it means that when we're reading it...we're not going, oh shit, he's writing something completely different.

We recognise that this process would likely have been more challenging had we not found this common ground early in the project.

The more formal process of conducting an analysis of each other's primary research papers was central to our border crossing efforts (authors, 2017). Whilst our use of terms was theoretically informed, our analysis was less an analysis of how concepts were being used in theory and more an analysis of how we as researchers were deploying the terms. Consequently, this took the form of a colloquial concept analysis (Risjord, 2009). We believed these papers best represented our respective thinking as they were applied to physical education and believed the analysis would likely generate a series of commonalities and challenges for discussion. We independently reviewed each other's paper through our own theoretical lens, reading, annotating, sharing, transcribing, analysing and synthesising in our roles as co-researchers and co-subjects of the research. We wrote a summary statement from one section of the other's paper and then provided a commentary, often posing a question, critique or stating agreement.

The following provides an example of Peter's commentary about something John said about complexity in his paper:

I can see some significant synergy between exploring ideas like 'edge of chaos' and socio-ecological systems that determined where an individual's edge might lie...Whilst my paper started from ecologies and partly worked inwards, this one starts from complexity and works outwards to ecologies.

In this commentary, the search for shared understandings is evident. There is an acknowledgement of synergy and agreement and a subtle nudge that suggests a slightly different perspective has something to add. We see the emergence of ideas leading to elements within Principle 5 and some of the notions of innovation in Principle 1. At this stage, annotations comprised points of agreement, points of departure, points for clarification and points for practice and application.

In our initial conversation about the papers, our intention was to use the analyses to generate a more detailed frame of reference around concepts that would guide a more focused second reading of the papers as outlined in Peter's following comment:

We've done an analysis of each other's paper [and histories], it's about then putting those two analyses side by side and going, 'what do we have in common, what were the points of departure'?

We believed this would help us identify and discuss key concepts in a more systematic way, and ideally embark on a more formal concept analysis approach. However, without the principles to frame discussions, our conversations frequently drifted, became time consuming, led to repetitions and often failed to unpack conceptualisations. While we made significant progress using data from the original

meeting, historical summaries and paper annotations, it was only in some of the early Skype conversations that we sought clarification and agreement about key concepts. Whilst we felt we were experiencing productive dialogue at the boundary, a more deliberate strategy associated with concept analysis or vertical compatibility and a better understanding of principles 4 and 5 would have helped greatly.

Principle 5: an ongoing process where translation is difficult but can yield substantive change.

Following the second review of the papers, we held the five online conversations which were loosely structured around ideas from the historical narratives, annotated paper readings and previous conversations. Without a deliberate process for unpacking concepts, however, we became stuck on big ideas and lacked a way to move our theoretical ideas towards translation. Two-years into the process we are only now reaching a point where we feel we can start to ‘crystallise’ outcomes that could have implications for practice. To develop these fully, we will need to revisit the processes outlined in Principle 4 and publish findings. Our experience resonates with Principle 5 and fits Akkerman and Bakker (2011) sentiment that ‘crystallisation’ is difficult to achieve and ongoing work is needed.

Conclusions:

Inspired by Evans (2014) and our own desire to connect to something bigger, we have outlined principles for small scale, collaborative and transformative border/boundary crossing. We acknowledge that work from transdisciplinary research, concept mapping, boundary crossing, concept study and threshold concepts have well established and detailed framings, processes and principles in their own right. Each offered insights into what we were attempting to do and, in combination, helped us develop border crossing

principles. In retrospectively applying these principles to our meandering and wavering border crossing efforts, we found a fit that would not only have been useful but would also have supported aspects we did not do well. We particularly learnt lessons from principles 2 and 4 but were reassured by the others. The hope is that these principles can serve to signpost researchers, teachers and anyone else embarking on their own border crossing exercise.

In the process of developing the foundations of complexity theory, Kauffman describes a long period where aside from knowing it was important, none of the team knew exactly what this new science was and remained driven by a mixture of confusion and passion over a considerable period of time (Ramage and Shipp, 2009). Whilst our work is far more modest, we relate to the sentiment that border crossing is part confusion, part passion and a feeling that something important may emerge. This draws us to the obvious conclusion that border crossing may not be for everyone. The notion of liminality can be applied to individuals embarking on border crossing, particularly in relation to careers and the agendas of modern academia. Being stuck in the in-between space is not overly comfortable, is time consuming, requires on ongoing relearning and broadening of horizons rather than what Tinning (2015) refers to as ‘circulating around in the one discourse community’ (p. 687). Particularly evident is this difficulty when attempting to forge an academic identity, benchmarked against what (Evans, 2014, p. 46) refers to as the ‘dislocating, divisive individualism’ of neoliberalism that is alive within the university system. It struck us during the process that by the time academics become comfortable in their own skin, the time, energy and sacrifice needed to confront well-established identities is quickly passing. As the push for interdisciplinary research continues, there may be a greater role for boundary spanners or border crossers who can work the in-between spaces and serve to bridge highly specialized expertise within and

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